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# Research Briefs

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## Nutrition and Health

Our genetic makeup has far less say over our levels of the "good" HDL cholesterol than it does over levels of the "bad" LDL cholesterol, according to a new study of twins. Funded by ARS and the National Heart, Lung and Blood Institute, researchers assessed the heritability of marker proteins for HDL and LDL. The proteins are thought to be better predictors of heart disease risk than HDL and LDL cholesterol values. The researchers compared blood levels of the proteins in 109 sets of identical twins, who come from a single fertilized egg, and in 113 sets of fraternal twins from two fertilized eggs. Levels of apo B, the only protein in LDL, were much more similar in identical twins than in fraternal, indicating that LDL levels are strongly determined by the genes. Similarities were much less distinct for levels of apo A-I, the major protein in HDL, indicating that heredity plays a weaker role in HDL levels. The researchers also found that the volunteers' body weight, exercise, smoking and alcohol consumption habits accounted for 12 percent of the variability in apo A-I levels compared with only one percent in apo B. As seen in other studies, maintaining an ideal body weight, regular exercise and moderate use of alcohol—a drink or less a day—may help increase HDL levels.

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Galactose, a milk carbohydrate that one infant in every 30,000 to 60,000 can't tolerate, has been found in various fruits and vegetables. Working with Ross Laboratories, ARS scientists found galactose in varying levels in 41 fruits and vegetables, including baby food. An infant born with the inherited disease galactosemia suddenly begins to vomit, lose weight and become lethargic a few days after birth. Usually, the symptoms disappear after milk is eliminated from the diet. But even after a change in diet, some patients show poor growth, mental retardation, speech problems and other symptoms. Along with Auburn University's Department of Nutrition and Food Science, ARS tested baby foods from three companies and found galactose in 12 fruits and vegetables. Applesauce, bananas and squash contained high levels. ARS is cooperating with medical researchers to determine if affected fruits and vegetables should be eliminated from diets of infants and children who can't tolerate galactose. Galactosemia is not the same as lactose intolerance, which develops when a person (usually an adult) can't digest lactose in milk.

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Copper-deficient mice took 2.5 times longer to dissolve blood clots than mice that got adequate copper in their feed. The finding adds more evidence to a theory that coronary heart disease may be linked to inadequate copper intakes in the U.S. and other industrialized countries. Heart disease patients also take longer to dissolve clots when assessed by the same test done on the mice—the euglobulin clot lysis test (ECLT). Tiny blood clots are part of the plaque-forming debris that accumulates in arteries, gradually narrowing the vessel and reducing blood flow. If clot dissolving is impaired, the clot thickens—and so does the plaque. This finding is among the latest of more than 60 similarities noted between animals deficient in copper and people who have heart disease.

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A group of obese young women averaged a two to three percent loss of bone during a controlled, five-month weight-loss study, even though they exercised regularly and got ample dietary calcium. Also, biochemical tests showed that the women had a higher rate of bone breakdown and a

lower rate of bone formation during the three months their calorie intake was cut in half. Obese women generally are thought to have a lower risk of osteoporosis than lean women because of a larger bone mass. But that margin of risk narrowed in this study—the first to look at the consequences of weight loss on bone mass. The findings have implications for people who lose and gain weight in a yo-yo fashion. If they don't regain the lost bone each time they regain weight, they could be at higher risk for osteoporosis than previously thought.

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**Chromium** acts on the body's insulin-secreting cells, new findings show, as well as on the insulin molecule itself. Beta cells in the pancreas manufacture and store insulin until a rising blood sugar level signals them to release it. Now a study of rats fed either chromium-deficient or chromium-sufficient diets shows that the element enables the cells to respond quickly to the glucose signal. The pancreases of chromium-deficient rats secreted 40 to 50 percent less insulin than those of chromium-sufficient animals during the early stages of stimulation with a glucose solution. Chromium helps normalize blood sugar levels, but few people get even 50 micrograms (mcg) of this essential trace element daily—the bottom of the suggested 50 to 200 mcg/day intake. It is known to make circulating insulin more efficient at getting blood glucose into body cells and metabolized. Apparently, it also helps the beta cells secrete enough insulin to handle the glucose from a meal.

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A **streamlined analysis for cholesterol** in mixed foods cuts 75 percent of the time and considerable cost off the method currently sanctioned by the Association of Official Analytical Chemists. The new method would be useful to food companies that are analyzing mixed foods, such as chili or meat loaf, to meet labeling requirements regarding cholesterol. Like the official AOAC method, it uses a chloroform-methanol-water solvent system to extract lipids (fat and cholesterol) from the mixed foods, but the remaining steps have been streamlined, updated or eliminated. The simplified method measures cholesterol with a gas chromatograph—standard equipment in most analytical labs. Other methods that don't require solvent extraction are more popular because chloroform can be toxic to workers and is costly to dispose. However, the solvent-extraction method is more versatile because it allows scientists to measure total fat and assess the composition of fatty acids—polyunsaturated, monounsaturated and saturated—as well as measure cholesterol.

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To accurately detect zinc deficiency in people, health professionals and researchers need to assess zinc levels in both blood plasma and urine. In a study at the Grand Forks Human Nutrition Research Center, researchers confirmed that people who score low for both plasma and urinary zinc are truly deficient. But measuring blood plasma alone can give a false picture of a person's zinc status for several reasons. Plasma levels tend to remain high despite a low-zinc intake, then fall off dramatically when deficiency becomes severe. Also, an infection or disease can artificially raise or lower plasma zinc. And even people who get adequate zinc in their diets have widely varying levels of the mineral in their plasma. The range for urinary zinc levels also varies greatly, making it hard to distinguish a deficient person from one who is at the low end of the "normal" range when only one measurement is used. Zinc is necessary for protein synthesis in every cell of the body. Rich sources of the mineral include beef, whole grain breads and cereals, shell fish, organ meats and nuts.

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**Dividing a person's lean body mass** by his or her knee height—the base of the heel to the knee—gives a more accurate gauge of the individual's fatness relative to the population than Body Mass Index (BMI), a study shows. Researchers agree that the BMI tables—used for four decades to assess the health status of individuals and the general population—are in need of an overhaul. BMI divides a person's weight by height squared. But using weight as the variable in the ratio doesn't give an accurate picture of people's fat vs lean mass—the bottom line for gauging health status. For instance, football players, who score a very high BMI, are mostly muscle. Thin elderly people—who score low—generally have a much larger proportion of fat than younger people of similar size. Another problem arises from using total height as the constant because we shrink as we age, mostly in the spine. This also confounds comparisons of BMI in different age groups because we don't all shrink to the same degree or at the same age. Looking for better measurements that could be done in the doctor's office, researchers tested knee height as the constant in combination with lean body mass in 610 people from 27 to 74 years old. Although knee height decreased with age, the decrease was only one quarter that of total height in females and one fifth that in males. When indexed to knee height, lean body mass decreased in older men as expected. But this decrease did not show up when lean mass was indexed to total height. The men's lean mass was estimated by a relatively simple method called bioelectrical impedance, which measures people's resistance to a weak electrical current.

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## **Tomorrow's Foods**

**Carbonated beverages made from milk** could be on the market within a year—the product of a research and development agreement between ARS and a New Orleans company. National Fruit Flavor Co. Inc., which manufactures flavor concentrates, syrups and other ingredients for the beverage industry, is working on several types of beverages—such as iced-Cappuccino, orange juice and strawberry milks. They would possibly be available to consumers by January 1993. ARS scientists make carbonated milk from a mixture of reconstituted non-fat dry milk, skim milk and fruit juice. Then, the mixture is kept under pressure and bottled so the carbonation doesn't escape. A market for carbonated milk could help reverse the decline in the consumption of milk, which supplies much of our calcium. U.S. consumers drink 280 billion containers of beverages annually. Soft drinks are projected to grow at an annual rate of eight percent by 1995. *Southern Regional Research Center, New Orleans, LA*  
*Ranjit S. Kadan, (504) 286-4332*

**A new way to make cow's milk as easily digestible** and non-allergenic as mother's breast milk has been developed by ARS scientists. Cow's milk and breast milk differ significantly in protein concentration, making mother's milk more nutritious and easily digested than cow's milk. But cooling and molecular filtration of cow's milk results in comparable levels of protein, casein and whey found in breast milk. The researchers used salt and adjusted pH levels to remove a protein component in cow's milk that can cause allergic reactions in infants. Up to now the dairy industry had to use costly separate steps to alter protein levels. But, none of these steps removed allergy-causing proteins. Based on principles of making cheese and other dairy products, the dairy industry can adjust processing methods for continuous production of the modified milk. Several companies are interested in licensing the technology.

*Eastern Regional Research Center, Philadelphia, PA*  
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**Smaller nectarine and peach trees** that yield as much fruit as large trees will be available to growers in a few years. Scientists have bred small nectarine and peach trees that can be planted in higher densities than their big cousins, reducing land and operating costs. Over 1,000 of these new trees can be planted on an acre of land that will accommodate only several hundred larger trees. Other payoffs: the trees require less pruning and are easier to harvest.

*Appalachian Fruit Research Station, Kearneysville, WV*  
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**Checking up on chickens** in a harmless magnetic field could help breeders get leaner poultry to the supermarket meat case. Besides chicken fat's unpopularity with consumers, it costs producers money—some \$500 million annually in chicken feed that birds use only to make a triangular mass of abdominal fat, which must be discarded. Physicians use magnetic resonance imaging or MRI to detect everything from tumors to hearing defects. Now, ARS researchers have modified MRI so poultry breeders and scientists can follow muscle and fat development in chickens from the day they hatch. The technique employs a magnetic field to graphically depict soft body tissue. That lets the scientists make computer-generated, three-dimensional maps of—for example—a chicken breast, the most economically important part of the bird. Breeders seeking to produce chickens with larger and leaner breasts would use the “chicken map” to select the best birds for breeding. *Non-Ruminant Animal Nutrition Laboratory, Beltsville, MD*  
*Alva D. Mitchell, (301) 504-8868*

**Feeding canola and soy lecithin** to lambs may give consumers meat that's lower in cholesterol and saturated fatty acids. Researchers fed ram lambs a diet of alfalfa along with whole canola seed and soy lecithin added both separately and in combination. Oil in canola seed is high in unsaturated fatty acids, and soy lecithin may increase the absorption of fatty acids in the small intestine. Feeding soy lecithin increased the healthful polyunsaturated fatty acids in lean meat by 18 percent. Feeding whole canola seed reduced saturated fatty acids—which can increase the amount of cholesterol in the body—in lean meat by nine percent. Feeding the combination of whole canola seed and soy lecithin had little effect on fatty acids in lean meat. Cattle will be tested after further field tests on lambs. *Meat Science Research Laboratory and Ruminant Nutrition Laboratory, Beltsville, MD*  
*Morse B. Solomon, (301) 504-8400*

**Experimental tomatoes** from ARS contain less water and up to three times as much of the solids that are condensed to make salsa, catsup, spaghetti sauce, and other products. The industry estimates that, if commercial varieties of the new tomatoes become available, each percentage-point increase in solids could be worth \$70 million a year. Today's commercial tomatoes average about five percent solids and 95 percent water, which is costly to remove during processing. But some of the research tomatoes have as much as 15 percent solids. A ton of those tomatoes would yield 300 pounds of solids—triple the yield of typical tomatoes. A major U.S. producer of farm and garden seed is testing the best of the experimental tomatoes under a cooperative agreement with ARS. *Western Regional Research Center, Albany, CA*  
*Merle L. Weaver, (510) 559-5760*

## **Food Freshness and Safety**

Cone-shaped pieces of plastic resembling badminton birdies are helping gardeners fight over 100 garden and shade tree pests this summer. Inside the cone—marketed as Rescue—is a sex scent, or pheromone, that attracts spined soldier bugs into an area so they will devour gypsy moth caterpillars, Mexican bean beetles, cabbage loopers, corn earworms, and other pests. One cone can attract 50 or more spined soldier bugs in one day, if it is put out one week before the bud-burst of the red maple tree from early March to mid-April. It is the first commercial pheromone attracting beneficial insects. ARS replicated and patented the beneficial bug's natural pheromone, which attracts soldier bugs of both sexes as well as the immature bugs. Sterling International, Inc., of Liberty Lake, WA, obtained an exclusive license for the chemical blend and formulated it into a plastic cone. ARS scientists evaluated the various formulations to find the most effective one.

*Insect Chemical Ecology Lab, Beltsville, MD*  
*Jeffrey R. Aldrich, (301) 504-8531*

A natural insecticide that comes from neem, a tropical mahogany tree, can give growers and home gardeners alternatives to synthetic insecticides like diazinon, malathion and carbaryl. ARS scientists studied the neem seed extract in the late seventies and identified an active chemical as azadirachtin. Tests showed the extract could control over 80 major insect pests by disrupting hormonal changes in the insect larva, causing death during molting. Neem is effective against greenhouse insects as well as other pests like beetles, aphids, grasshoppers, weevils, fruit flies, gypsy moths and mosquitoes. The ARS studies helped pave the way for three commercial formulations—Azatin, BioNeem and Margosan-O—registered for use on ornamentals and other non-food plants. Registration for use on food crops is underway. The extract is nontoxic to honey bees, other beneficial insects and earthworms and won't harm birds or humans. ARS scientists currently are looking at other neem-based products for use as a fungicide.

*Florist and Nursery Crops Lab, Beltsville, MD*  
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A coloring process to replace the controversial food colorant Red Dye No. 3 in maraschino cherries has been developed and patented by ARS scientists. The new process prevents "bleeding" of dyed maraschino cherries in products like fruit cocktail and fruit salad. Red pigments, known as carotenoids, are used as the key ingredient and can be produced synthetically or derived from natural sources such as algae and red peppers. Carotenoid pigments are currently approved for food use by the Food

and Drug Administration. Two companies are seeking licenses on this patented technique.

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New experiments with the unique, squash-like chayote (shy-O-tay) will pinpoint its ideal shipping and storage temperature. ARS researchers want to protect this vegetable's delectable taste and firm texture while keeping it from sprouting prematurely. Preliminary tests indicate 60 degrees F is best, but this must be validated. Researchers expect immigrants from Central and South America and Asia to boost demand for this member of the gourd family. Chayote tastes a bit like cucumber, but is crisper and lighter. It's high in fiber and a good source of potassium, iron, calcium and vitamin C. In color, the peel ranges from green to yellow to creamy white. The flesh is usually a lighter shade than the peel. Typically, chayote is marketed at about the size and shape of a mango. Its tender shoots and roots also are eaten, and the vine makes an attractive ornament along fences. The U.S. imports nearly 8,000 tons of chayote each year. A native of Central America, it has spread to other tropical and subtropical areas. In the U.S., it's commercially grown in California and in Florida where it's called vegetable-pear and in Louisiana where it's known as mirliton.

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Using a gel made of organic acids and calcium alginate to kill bacteria on meat may provide one solution to a nagging food safety issue. Researchers dipped pieces of raw lean beef—artificially inoculated with the food pathogen *Listeria monocytogenes*—in a mixture of acetic acid and calcium alginate gel. The acid-gel mixture reduced by 90 percent the number of live bacteria on the meat, whereas acetic acid alone reduced the bacteria only 70 percent. Evaluations were made after keeping the meat refrigerated at 41 degrees F for seven days. *L. monocytogenes* doesn't grow on frozen meat, but it is able to grow on chilled meat. The Food and Drug Administration allows the use of calcium alginate as a food additive. And alginate gels have been used to prevent shrinkage of sheep carcasses. But additional research is needed before this process is ready for approval for commercial use.

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